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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/977,069	10/11/2001	G. Ramanath	020752-000121US	9488

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EXAMINER

KIELIN, ERIK J

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 08/21/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/977,069

Applicant(s)

RAMANATH ET AL.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 August 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 October 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

Double Patenting

1. Claim 1 of this application conflicts with claim 12 of Application No. 09/976,927. 37 CFR 1.78(b) provides that when two or more applications filed by the same applicant contain conflicting claims, elimination of such claims from all but one application may be required in the absence of good and sufficient reason for their retention during pendency in more than one application. Applicant is required to either cancel the conflicting claims from all but one application or maintain a clear line of demarcation between the applications. See MPEP § 822.

Note that the claims are verbatim duplicates.

Information Disclosure Statement

2. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Note that several references, which are not easily available, are listed in paragraphs [15] through [17], and [25].

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-5 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,079,600 (Schnur et al.).

Regarding claims 1, **Schnur** discloses a diffusion barrier (Fig. 1A, called “thin film”) in an integrated circuit (Abstract), wherein the diffusion barrier is a self-assembled monolayer, SAM, (col. 10, lines 42-47). (See also the sections entitled “EXAMPLE 1” col. 11, lines 24-58 wherein the barrier layer is formed from “octenyldimethylchlorosilane” covalently bonded to the substrate. See also “EXAMPLE 3,” “EXAMPLE 5” and “EXAMPLE 28” col. 21.) It is seen to be inherent that the “thin film” is a diffusion barrier, because it is the same material as that disclosed by Applicant, and because a “metal” film is formed on the “thin film” and is shown in the **Schnur** figures not to be diffused through the thin film SAM, thereby meeting Applicant’s definition of “diffusion barrier.”

Regarding claims 2-3, EXAMPLE 28 at col. 21, discloses a SAM formed from trichloro-(4-pyridyl)-ethyl-silane which forms the equivalent SAM barrier layer as shown in structure entitled “1” on p. 7 of the instant specification. Accordingly, it is held, absent evidence to the contrary that the thickness of the barrier layer is both less than 5 nm and less than 2 nm because the same molecule, forming the same SAM, is used in **Schnur** as that in the instant application. (See also col. 9, lines 43-57 for further disclosure of the SAM.)

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Regarding claim 4, the pyridyl group is aromatic and is at the terminus of the SAM because bonding to the substrate occurs via the silicon atom, by replacement of the chloride groups with oxygen atoms bonded to the substrate.

Regarding claim 5, EXAMPLE 1 at col. 11, indicates that copper metal is plated on the SAM.

5. Claims 1-5 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,389,496 (Calvert et al.).

Calvert discloses an integrated circuit (sentence bridging cols. 10-11) comprising a silicon substrate (col. 10, lines 52-53), a diffusion barrier layer (called “chemical groups” or “catalyst ligating groups”), wherein the diffusion barrier layer is covalently attached to the silicon substrate (col. 3, 56 to col. 4, line 8), and wherein the diffusion barrier is a self-assembled monolayer (col. 7, lines 33-34). A metal is then deposited on the diffusion barrier layer (col. 4, lines 58-61).

Note that although no drawings are provided, the subject matter is the virtually exactly same as that in the Schnur reference above which is a parent patent of the Calvert patent and is therefore incorporated by reference in its entirety including the Figs. Accordingly, it is seen to be inherent that the covalently bonded “chemical groups” or “catalyst ligating groups” of Calvert inherently form a self-assembled monolayer which serves as a diffusion barrier layer for the reasons indicated above in reference to Schnur. Moreover, in “EXAMPLE 1” of Calvert beginning in col. 12, the sentence bridging cols. 12 and 13 indicate that the “catalyst ligating group” (called now a “silane compound”) provided *monolayer* coverage of the substrate (a silica

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slide in this example). Because the silane compound is bonded to the surface by reacting only with available surface sites, it is by definition also *self-assembled*. Accordingly, even without the benefit of the **Schnur** reference, the diffusion barrier in **Calvert** is seen to be a self-assembled monolayer, covalently bonded to the surface of the substrate. Once the diffusion barrier is formed, it is treated with a catalyst and then electroplated (just as in **Schnur**) to form a metal layer on the diffusion barrier. (See **Calvert**, at least EXAMPLE 1 and EXAMPLE 20.) , “EXAMPLE 1” col. 12, “EXAMPLE 20” col. 18, “EXAMPLE 21” col. 19, each use the silane compound β -trimethoxysilylethyl-2-pyridine which leads, by reaction with the substrate surface, to the diffusion barrier having the structures as instantly claimed.

Regarding claims 2-3, as noted in the examples of Calvert above, discloses a SAM formed from β -trimethoxysilylethyl-2-pyridine, which forms the equivalent SAM barrier layer as shown in structure entitled “1” on p. 7 of the instant specification. Accordingly, it is held, absent evidence to the contrary that the thickness of the barrier layer is both less than 5 nm and less than 2 nm because the same molecule, forming the same SAM, is used in **Calvert** as that in the instant application.

Regarding claim 4, the pyridyl group is aromatic and is at the terminus of the SAM because bonding to the substrate occurs via the silicon atom, by replacement of the chloride groups with oxygen atoms bonded to the substrate.

Regarding claim 5, copper metal (col. 4, lines 58-61) deposited on the diffusion barrier layer.

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Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 5,077,085 (**Schnur** et al.), US 5,468,597 (**Calabrese** et al.), US 5,500,315 (**Calvert** et al.), US 5,510,216 (**Calabrese** et al.), US 5,648,201 (**Dulcey** et al.), US 6,348,240 B1 (**Calvert** et al.) each are related patents and share common inventors to the **Schnur** and **Calvert** references applied above and are believed to anticipate at least the independent claims, as presently claimed.

US 5,057,339 (**Ogawa**) in Fig. 1C anticipates at least instant claim 1.


US 5,939,150 (**Stelzle** et al.) anticipates at least instant claim 1.

Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov. The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached at (703) 306-2794 or by e-mail at olik.chaudhuri@uspto.gov. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.


EK

August 12, 2002


Olik Chaudhuri
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